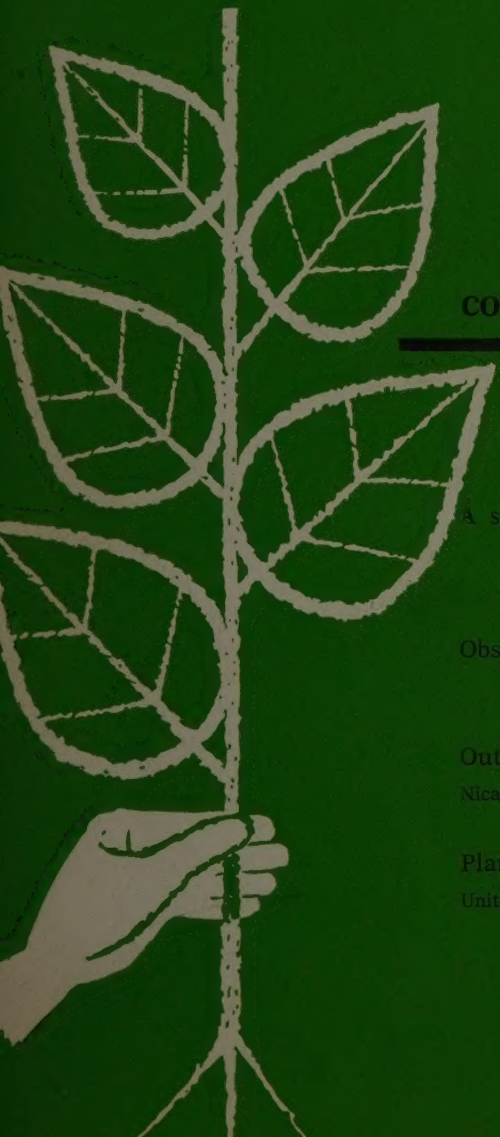
APRIL 1959 VOL. VII

FAO PLANT PROTECTION BULLETIN 7

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS - ROME

A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS



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FAO PLANT PROTECTION BULLETIN

is issued as a medium for the dissemination of information received by the World Reporting Service on Plant Diseases and Pests, established in accordance with the provisions of the International Plant Protection Convention, 1951. It publishes reports on the occurrence, outbreak and control of pests and diseases of plants and plant products of economic significance and related topics, with special reference to current information. No responsibility is assumed by FAO for opinions and viewpoints expressed in the Bulletin.

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The Bulletin is issued monthly in English, French, and Spanish, and twelve numbers, commencing with the October issue in each year, constitute a volume. Subscription rates are $ 3.00 or 15s. per annum; single numbers are priced at $ 0.30 or 1s. 6d. The citation is FAO Plant Protection Bulletin, or, in abbreviation, FAO Plant Prot. Bull.

Vol. VII, No. 7 - April 1959

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A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

A Status Report on Forest Insect Conditions in the United States in 1958[1]

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General summary

The scope and severity of forest insect infestation in the United States during 1958 were not markedly changed from conditions existing in 1957. While some of the pest species increased in numbers in some sections of the country, other species declined elsewhere, thus offsetting what otherwise would have been more damage and destruction than in prior years.

1. Several species of bark beetles occurred in outbreak numbers in many places in the coniferous forests of the West and South but the extent of outbreaks and their severity were somewhat reduced from previous years. The reduction of bark beetle infestations was brought about largely by suppressive control action on the part of public and private agencies. Low winter temperatures, however, particularly in the Southeastern States, also killed a large percentage of southern pine beetle broods, thus aiding the effectiveness of direct control action in that area. Nation-wide, a total of 784,517 infested trees, cull logs, and stumps were treated with insecticides or salvaged from outbreak areas.

2. The spruce budworm continued in epidemic status in much of the spruce-fir forests from coast to coast. Infestations were most severe in Maine, Minnesota, the northern Rocky Mountains, Arizona and eastern Oregon. Lesser infestations occurred in Wisconsin and Michigan; in the central and southern Rockies; in New Mexico; and in one area in northeastern California. Aerial spraying to reduce epidemic populations and to prevent damage and destruction of forest stands was undertaken on a total of 1,231,911 acres: 301,861 in Maine; 12,000 in Minnesota; 100,000 in Arizona and 818,050 in Oregon. A lesser acreage is expected to be sprayed during 1959.

3. A variety of other defoliating insects occurred in outbreak numbers in all sections of the country. Several species of pine sawflies were particularly abundant in the East and South; needleminers were destructive in the West; tent caterpillars were numerous in the Lake States, the Northeast and the Southwest; and loopers, leafrollers, webworms, tussock moths were abundant in various other places. Aerial spraying on 11,066 acres was undertaken to suppress epidemic populations, and in most instances excessive damage to the forest resource was averted.

4. Twig- and terminal-feeding insects were quite prevalent in most sections of the country and excessive damage was caused in many places, particularly in areas where pine stands are being regenerated by planting. Suppressive action for control on some 5,000 acres was initiated against such pests as the white pine weevil, European pine shoot moth, Saratoga spittlebug and pine reproduction weevils in many areas, to protect plantations and reproduction.

5. The balsam woolly aphid continued in epidemic proportions in large areas in the Northeast and in the Pacific Northwest, and the pest was destructive in stands of Fraser fir in the Southeast. A major effort was made during the year to introduce and establish predaceous beetles

[1] This report is based upon information submitted by co-operators the Federal land-managing agencies, state forestry and conservation organizations, lumber companies, timber operators, and private landowners.

from Europe and Japan for biological control. Effectiveness of the predators in control of the aphid is not yet known but there are indications of successful colonization of two of the species liberated.

6. Outbreaks of the Douglas fir tussock moth were discovered for the first time in fir forests of New Mexico and at a new location in Arizona. In addition, the New Mexico fir looper reappeared in outbreak numbers on a portion of the Lincoln National Forest, the first since 1952. These infestations, discovered late in 1958, will be treated during 1959, in an effort to prevent undue loss of the resource being attacked.

Alaska

Forest insect activity in Alaska increased during the year and continuing infestations at moderate levels are expected in several areas in 1959. The Alaska spruce beetle increased in portions of the white spruce stands on the Kenai Peninsula and, for the first time in two years, new infestation centers of hemlock sawfly and blackheaded budworm occurred at several locations in southeast Alaska. The spear-marked black moth, which erupted as an epidemic in stands of paper birch on some 5,900,000 acres near Fairbanks in 1957, began to decline during the summer months due to parasites and a disease organism affecting the larval populations. The Sitka spruce beetle was endemic over its entire range and no further damage was reported by *Ips* beetles. There was no direct action undertaken to suppress any of the insect infestations in Alaska.

California

Losses due to forest insects decreased to some extent in California. In some of the high-elevation recreational forests, however, this was not the case. Lodgepole pine, in particular, continued to sustain severe infestations of the mountain pine beetle and lodgepole needleminer. Jeffrey pine in these high elevation forests was also damaged by Jeffrey pine beetle, and late in the year signs of increased bark beetle activity began to show up in several localities throughout the state. The status of the major insects is as follows: The western pine beetle in ponderosa pine decreased; the mountain pine beetle in lodgepole pine increased; the Jeffrey pine beetle was active in many parts of the state; the Douglas fir beetle showed signs of increased activity in northwestern California; the California flatheaded borer in ponderosa and Jeffrey pine occurred in outbreak numbers in southern California; pine engravers caused little damage early in the year but showed signs of increasing late in the fall; the fir engraver was epidemic in only a few local areas; the lodgepole needle miner remained epidemic in lodgepole pine, with one new center of infestation discovered; seed and cone insects caused serious damage and, for the first time in many years, Douglas fir engraver infestations were common in young Douglas fir in northwestern California. Suppressive action to control bark beetles and flatheaded borer was intensified in southern California and a method was developed for control of the lodgepole needle miner.

Oregon and Washington

Outbreaks of forest insects in Oregon and Washington occurred on slightly over 2 million acres, most of which were infested with the spruce budworm, balsam woolly aphid, Douglas fir beetle, mountain pine beetle, and western pine beetle. Aerial spraying of 818,050 acres, coupled with natural control, reduced the spruce budworm to the lowest point since 1947, and the population trend is downward. Tree killing by the balsam woolly aphid declined but the area affected expanded and the insect population flared up late in the season. Efforts were intensified during the year to introduce predaceous beetles from Europe and Japan for control of the aphid. A severe outbreak of the Douglas fir beetle developed in southern Oregon but there were indications that the infestation will decline during 1959. The western pine beetle and mountain pine beetle flared up generally in the pine regions of both states but only the former species is viewed with alarm currently. Suppressive control for the Douglas fir beetle was limited to salvage of infested trees. The selective removal of high-risk trees from eastside stands of ponderosa pine was intensified as an indirect measure for control of western pine beetle.

The Rocky Mountains

Forest insect infestations in the northern Rocky Mountains were similar in most respects to conditions during the previous year. Bark beetle activity, especially that of the mountain pine beetle increased, and the Douglas fir beetle appeared to be entering a new cycle of destructiveness. The Engelmann spruce beetle was epidemic only in local areas in and adjacent to previous outbreak centers. Defoliating insects, as a group, were the principal pests in the region. Although infestations of spruce budworm were static, intensity of tree defoliation increased in some areas. The larch casebearer, a relative newcomer in the northern Rockies, spread to additional areas. Although there was no aerial spraying for control of spruce budworm

during the year, action programs were continued for control of Engelmann spruce beetles, and 159,725 infested trees were salvaged.

In the central Rockies, losses increased and infestations of outbreak proportions occurred on over a million acres. The Engelmann spruce beetle continued as a problem in Colorado and Wyoming and new epidemics developed on portions of three national forests in Utah. The Black Hills beetle, mountain pine beetle, and Douglas fir beetle increased in numbers, and outbreaks were numerous and widespread. For the first time in several years, heavy defoliation of fir, spruce, and pine by spruce budworm occurred in Colorado, and budworm infestations continued in Idaho. The Great Basin tent caterpillar was noted throughout southern Colorado and heavy defoliation of the aspen type is forecast again for 1959.

The Southwest

Insect activity decreased sharply in Arizona and New Mexico, even though infestations of some species were more severe than in past years. Tree killing caused by bark beetles was greatly reduced from levels of 1957, and defoliation of ponderosa pine by a needleminer almost disappeared. In contrast, damage to fir and spruce by spruce budworm increased; two additional areas were found infested by Douglas fir tussock moth; and infestations of Douglas fir beetle were more acute. Logging infested trees was continued as a measure for control of pine bark beetles, supplemented to the extent needed by spraying infested trees with toxic oils. The spruce budworm was brought under control by aerial spraying on 100,000 acres in Arizona, and tent caterpillars were combatted by introducing virus organisms into outbreak centers or by aerial application of DDT sprays.

The Lake States, Central States and the Northeast

The scope and intensity of the more important forest insects in the Lake States, Central States and the Northeast were not greatly different in 1958 from the previous year. The spruce budworm caused moderate to severe defoliation of balsam fir in Maine, Minnesota, Wisconsin and Michigan, and aerial spraying was undertaken to suppress infestations on 313,861 acres. Populations of the jack pine budworm were generally light throughout Michigan and Wisconsin and suppressive controls were not needed in any area. Other pest species such as the European pine shoot moth, Saratoga spittlebug, white-pine weevil, larch sawfly, pine sawflies, tent caterpillars, the gypsy moth, and others were not materially changed from conditions in 1957. In all cases where infestations were most severe, suppressive controls were initiated to protect the forest resource. Control was needed, for example, to suppress the Saratoga spittlebug, shoot moths, sawflies, weevils, tent caterpillars, and the gypsy moth. The latter control program, a co-operative undertaking between the Agricultural Research Service and the States, involved spraying on 510,000 acres.

The Southern and Southeastern States

The insect situation in the Southern States is much improved over conditions of a year ago but several pests continue as a constant threat to the timber stands. Early in the year, rapidly developing infestations of southern pine beetle seriously threatened stands of southern pines in the Big Thicket area of southeast Texas but all were effectively suppressed by public and private agencies by late summer. In the South and Southeast, tree killing by the major bark beetles was less widespread than has been the case for the past several years. However, action programs in control involved spraying or salvaging over 415,000 trees. The extreme low temperatures of 1957-58 killed most of the larval broods of the southern pine beetles in the Southeast and, for unknown reasons, black turpentine beetle activity diminished almost entirely by mid-year. Other insects, however, occurred in outbreak status over large areas and are of considerable concern; sawfly infestations were epidemic in Virginia, North Carolina and in north-central Florida; and an outbreak of the elm spanworm spread over 570,000 acres in Georgia, Tennessee and North Carolina. The balsam woolly aphid, a new pest in the Southeast, threatens the fir resources on Mt. Mitchell and in other areas in North Carolina.

Suppressive controls were not undertaken for sawfly and spanworm infestations, although methods for doing so were developed and will be put to use, if needed, during 1959. Missible oil sprays will be tried on a pilot basis for control of woolly aphid on high-value trees in heavily used recreational areas in North Carolina.

Status report on insect pests

MOUNTAIN PINE BEETLE, *Dendroctonus monticolae* Hopk. The Mountain pine beetle, a serious pest of the more important species of pines in the Western States, occurred in outbreak proportions in many areas. Stands of lodgepole pine in the Rocky Mountains were most affected but outbreaks also were reported in tree species in other Western States as well.

In the lodgepole pine forests of the Intermountain Region, infestations continued on an upward trend. Many outbreak areas have increased in size and some new centers of infestation developed. Currently, some 22 epidemic infestations occur in five national forests in Utah, south Idaho and western Wyoming, and others are known at Glacier and Grand Teton National Parks, and at other locations. The largest infestation reported, and one that poses a severe threat to large volumes of lodgepole pine, is on the Wasatch National Forest in Utah. In this area, more than 146,000 gross acres are infested and some 110,000 trees were attacked and killed during the year. In Oregon and Washington, infestations in lodgepole pine decreased, whereas in California the beetle continued to be very destructive at Yosemite National Park and in one area in Modoc County. In the same tree species in western Wyoming, an epidemic on the Shoshone National Forest continued unabated and some 10,000 additional trees were attacked and killed on the Wind River District during the flight season.

Infestations in western white pine occurred on some 268,000 acres on the Gifford Pinchot, Snoqualmie and Mt. Baker National Forests in Washington and on the Willamette National Forest in Oregon. The trend of these infestations, however, fluctuated both up and down.

Few infestations of any consequence were reported in stands of sugar pine in the Pacific Coast States but outbreaks in second-growth ponderosa pine did occur in a few localities. At Crystal Bay, Nevada, the beetle remained epidemic and an increasing rate of loss in similar stands was reported in the Boise National Forest in Idaho.

The extent of mountain pine beetle infestations in all areas and in all host types in the Western States was such as to preclude initiation of suppressive control action in all areas. However, control was undertaken in outbreak areas in the lodgepole pine stands of Idaho, Utah, California and Wyoming, and 71,900 trees were either sprayed with toxic oils or salvaged. In Nevada, the epidemic in second-growth ponderosa pine at Crystal Bay was brought under partial control by the co-operative efforts of public and private agencies. In this area, 6,010 trees were either sprayed with toxic oils or logged.

ENGELMANN SPRUCE BEETLE, *Dendroctonus engelmanni* Hopk. During the course of the past several years this major bark beetle has killed several billions of board feet of Engelmann spruce in the northern and southern Rocky Mountains as well as in portions of the Pacific Northwest. It is noteworthy, therefore, that the rate of tree killing in old outbreak centers is materially reduced. Although remnants of the epidemic in the northern Rockies still persist, infestations currently are confined largely to areas where spruce was preserved from logging in prior years. Most of the outbreaks now known in Montana and Idaho are confined to portions of the Flathead, Kootenai, Kaniksu, and Clearwater National Forests and, in the Beartooth Primative area, on the Custer National Forest.

New outbreaks of serious proportions were discovered early in the year on portions of three national forests in northeastern Utah. In these areas, populations developed to epidemic levels in windthrown trees in 1957, and some 150,000 standing trees were attacked and killed during 1958. In Colorado, beetle populations breeding in cull logs and windthrown trees along the edges of uncut strips of timber also attacked and killed some trees on the San Juan, Rio Grande and Gunnison National Forests and at a few other locations. Tree killing in Oregon and Washington is at a reduced level and epidemic outbreaks were recorded on only 8,480 acres as compared to 32,000 acres in 1957. On the Wenatchee National Forest in Washington, 1,920 acres were infested. In Oregon, there were 3,040 acres infested, most of which were on the north half of the Umatilla National Forest. Broods in all trees in all areas were generally light and the trend of these infestations is downward.

Suppressive action for control of epidemic infestation centers was continued in Montana, North Idaho and southern Colorado. In Utah, a stepped-up control program was needed to confine the new outbreak in that area. In all, 251,500 trees were salvaged or sprayed with toxic oils.

DOUGLAS FIR BEETLE, *Dendroctonus pseudotsugae* Hopk. Outbreaks of Doublas fir beetle showed up extensively in southwestern Oregon during the spring months, and elsewhere in Oregon and Washington later in the year. The most extensive infestations were recorded in the South Umpqua drainage and adjacent stands on the Rogue River National Forest but considerable tree killing was also recorded on the Siskiyou and Siuslaw National Forests. Smaller centers of aggressive infestation occurred on the Okanogan National Forest and Colville Indian Reservation in eastern Washington; the combined acreage of outbreak in both states totalled 931,480 acres. In Montana and north Idaho, activity of the beetle also increased, particularly in Swan Valley adjacent to the Flathead National Forest, and in the Fisher River drainage in the Kootenai National Forest. On the St. Joe and Nezperce Forests in Idaho, large groups of trees were killed and the outbreak at Yellowstone National Park continued. In Colorado and Wyoming, infesta-

tions were recorded on a total of 41,330 acres, a part of which contained outbreaks of severe proportions.

Although a decrease in area of infestations was reported from Arizona and New Mexico, the beetle population in those states still remains at a high level. In California, the insect continued in outbreak status in a portion of Siskiyou County, where it has been epidemic since 1954. Elsewhere in the state, however, infestations were at a comparatively low level. Control of Douglas fir beetle in all of the Western States was limited to the salvage of infested trees.

BLACK HILLS BEETLE, *Dendroctonus ponderosae* Hopk. The Black Hills beetle, a major pest on ponderosa pine in the Rocky Mountains and the Black Hills of South Dakota, occurred in outbreak status in several areas during the year. In Wyoming, population increases were noted in the Big Horn Mountains, in portions of the Black Hills, and in Colorado. Total area of infestation in all areas was estimated at 77,290 acres. No new infestations were reported from Arizona and New Mexico, and except for the long-standing outbreak on the Dixie National Forest in Utah, no other outbreaks of serious proportions are known elsewhere.

Direct control efforts against the Black Hills beetle involved spraying or salvaging 16,600 trees in portions of five states.

WESTERN PINE BEETLE, *Dendroctonus brevicomis* Lec. Increased tree killing by this important forest insect was general in the ponderosa pine forests of Oregon and Washington but was most evident on the Ochoco National Forest and the Warm Springs Indian Reservation in eastern Oregon. In Washington, infestations were most pronounced on the Okanogan National Forest and on the Yakima and Spokane Indian Reservations. Although all of these outbreaks still are in the light category, group tree killing characterizing severe outbreaks is increasing. In California, infestations throughout most of the commercial timber zone were at low levels. Principal localities where the insect was noted in outbreak proportions were in Modoc County, Shasta County, and at Harris Mountain in Siskiyou County. Infestations in Coulter pine in southern California also were more prevalent and more severe but below epidemic levels. In the northern Rockies, endemic losses were the rule throughout the region.

Although direct control was undertaken to suppress outbreak populations of the western pine beetle in a few areas, the selective removal of high-risk trees was intensified as an indirect measure for control. Salvage of infested trees was also used for control in many areas.

JEFFREY PINE BEETLE, *Dendroctonus jeffreyi* Hopk. This tree-killing bark beetle, a pest only of Jeffrey pine in California, showed signs of increased activity during the year. Infestations of rather severe proportions were noted in the mature and overwinter pine stands in portions of Fresno County and at Lassen Volcanic National Park in Lassen County. In southern California, the insect was particularly damaging in some of the prized forest recreational areas and in large second-growth timber in the vicinity of Truckee, in Placer County. The serious infestation reported in 1957 in the Cannel Meadows area in Tulare County is being brought under control by logging trees of high risk to attack. Logging infested trees was also used for control in a few areas.

SOUTHERN PINE BEETLE, *Dendroctonus frontalis* Zimm. The scope and severity of southern pine beetle infestations in the Southern and Southeastern States was much reduced in 1958 from the epidemic levels which have persisted for the past several years. The decrease in beetle activity in the Southeast is attributed largely to extreme low winter temperatures, which killed a large percentage of larval broods in the infested trees. However, populations were also reduced by logging and spraying a large number of infested trees. In the South, decreased beetle activity was also brought about by the concerted efforts of public and private agencies to suppress populations by spraying and salvaging about 75,000 infested trees. New infestations of serious proportions were reported from Tyrrell and Hyde Counties, North Carolina, and from the Big Thicket area of southeast Texas during the early spring months. However, the infestations in North Carolina subsided from unknown causes by the end of the year, and the Texas outbreak was suppressed by treating 1,500 trees. There have been no other infestations of damaging proportions reported from the Southern and Southeastern States.

BLACK TURPENTINE BEETLE, *Dendroctonus terebrans* (Oliv.). The black turpentine beetle continued to be a serious pest of pine in the Southern and Southeastern States. However, the scope and severity of losses caused by the beetle in 1958 were somewhat less than for the past several years. In the Southeast, for example, there were no serious infestations reported since early summer, despite increased cuttings in several areas where the insect had been a major problem in previous years. A similar lessening of beetle activity occurred in the Southern States but new build-ups of populations late in the fall months are a potential source of trouble in many areas in Mississippi and Alabama.

In the latter areas, attacks were especially common where timber was cut at intervals of several months, first for poles and piling, next for sawtimber, and finally for pulpwood. When cutting was terminated, beetles emerging from stumps spread and attacked standing trees, killing them by force of numbers.

Despite the decrease in severity of infestations, suppressive control by spraying infested stumps or the basal portion of standing trees was continued, and a total of 320,000 stumps and trees were treated with toxic chemicals.

SOUTHWESTERN PINE BEETLE, *Dendroctonus barberi* Hopk. The southwestern pine beetle, together with an association of *Ips* beetles and other *Dendroctonus* species, were reported to have killed large numbers of ponderosa pines on some 535,000 acres in Arizona and New Mexico. Tree killing was most severe on portions of the Coconino National Forest and the Fort Apache Indian Reservation in Arizona, and on the Cibola National Forest in New Mexico. In Nevada, the infestation at Charleston Mountain continues at a high level despite continued efforts to suppress populations by direct means. In the latter area, 339 trees were treated in the control program.

ROUNDHEADED PINE BEETLE, *Dendroctonus convexifrons* Hopk. The roundheaded pine beetle, often occurring in association with other bark beetles in beetle-killed ponderosa pine in the Southwest, was not reported as a problem in any area during 1958. A small outbreak on Mt. Graham, Colorado National Forest, Arizona, was suppressed in August by treating 29 infested trees, and no additional tree killing of any consequence has been found since that time.

ALASKA SPRUCE BEETLE, *Dendroctonus borealis* Hopk. Increased activity of the Alaska spruce beetle was reported in stands of white spruce at several places on the Kenai Peninsula in Alaska. Several large groups of dead and dying trees were observed along Resurrection Creek, Palmer Creek, Granite Creek and Quartz Creek, and tree killing is expected to continue at a fairly high level in and adjacent to the infested areas during 1959. To date, no action has been undertaken for control.

SITKA SPRUCE BEETLE, *Dendroctonus obesus* Mann. The recent outbreak of the Sitka spruce beetle in the vicinity of Blackstone Bay in southeast Alaska subsided completely during the year. No other infestations were reported, and populations of this major pest are believed to be at the lowest level of the past several years.

LODGEPOLE PINE BEETLE, *Dendroctonus murrayanae* Hopk. The lodgepole pine beetle was reported for the first time in a number of years from some drainages of the Gallatin National Forest in Montana. The beetle is ordinarily not a serious pest of lodgepole pine, and beetle-attacked trees this year were reported as having been previously injured by porcupine pitch moths, or mountain pine beetles. No control was needed.

CALIFORNIA FLATHEADED BORER, *Melanophila californica* Van Dyke. In many places in California, the California flatheaded borer continued in epidemic status, alone or in association with one or more species of pine bark beetles. Tree killing by the borer in southern California was quite heavy, of sufficient proportion to prompt an accelerated program in control by salvaging infested trees, logging high-risk trees, and in some cases by spraying with toxic oils.

PINE ENGRAVER BEETLES, *Ips* spp. Green slash created by logging, windstorms, right-of-way clearings, and in other ways, often is responsible for outbreaks of pine engraver beetles in and adjacent to disturbed areas. Reports from many sections of the country about flare-ups of engraver beetle infestations, mentioned their occurrence in association with fire-killed and wind-thrown timber and in areas disturbed by logging. In the South, three species of *Ips* beetles, *I. avulsus* Eichh., *I. calligraphus* Germ., and *I. grandicollis* Eichh., were reported from scattered locations in localized areas near burned-out areas and logging operations, and in overdense stands. In the Southeast, the beetles also occurred in localized areas adjacent to stands disturbed by logging. For the most part, attacked trees were scattered, except in eastern and southeastern Georgia, where group killing occurred in areas as large as one half acre.

In the coniferous forests of the Western States, *Ips* beetles were generally at a low endemic level. Damage caused by *I. oregonis* Eichh. in Oregon and Washington was least extensive in many years and outbreaks were recorded from only 11,000 acres. In California, *I. confusus* Lec. caused only light damage until the autumn months, when activity increased along the coastal areas in the central portion of the state. Damage in New Mexico and Arizona by *I. lecontei* Sw., *I. oregoni* Eichh. and *I. ponderosae* Sw. was extensive and quite serious, because one or more of the species usually made the initial attack in the top portion of pines, which later were attacked and killed by other bark beetles. The extensive infestation of *I. lecontei* in the pinyon-juniper stands in New Mexico declined to an extremely low level, due to high mortality of overwintering adults.

For the first time in several years, engraver beetles were abundant in nearly all of the Northeastern States. In all areas where *Ips*-killed trees were merchantable, major efforts were made to salvage them. Except for salvage and preventive measures, no other efforts were made for control.

FIR ENGRAVER, *Scolytus ventralis* Lec. There was little change in conditions of infestation of fir engraver beetles in Oregon and Washington, and outbreak areas which totalled 22,000 acres, approximately the same as in 1957, were evenly divided between the two states. Similar conditions occurred in California, and outbreaks for the state as a whole were quite localized and losses were moderate. Tree killing in the fir resources of the central Rocky Mountains, however, were severe in some areas and infestations on some 98,000 acres, mixed with *Dryocoetes confusus* Sw., occurred on portions of the Grand Mesa, Uncompahgre, Rio Grande, San Juan, White River, Medicine Bow and Arapaho National Forests. In New Mexico, a new infestation of severe proportions on 4,480 acres was discovered on the Lincoln National Forest, and the rate of tree killing in the fir stands on the Sandia Mountains continued at high levels. In this latter area, infestations are reported to have spread to an additional 2,000 acres. *D. confusus* decreased sharply in northern New Mexico and tree killing, now at a moderate rate, is confined to portions of the Carson and Santa Fe National Forests.

DOUGLAS FIR ENGRAVER, *Scolytus unispinosus* Lec. For the first time in many years, this insect was reported in outbreak status in parts of California. In cutover lands in Humbold and Mendoceno Counties, numerous groups of young Douglas firs were heavily infested and other infestations occurred in scattered locations southward.

SILVER FIR BEETLES, *Pseudohylesinus* spp. During the past several years, one or more species of fir engraver beetle have caused severe tree killing in fir stands in portions of Oregon and Washington. During 1957, infestations dropped to near endemic levels. In 1958, however, populations increased and tree killing was noted on some 5,000 acres as compared to only 1,120 acres infested last year. The severity of infestations is much less than was experienced in the recent outbreaks but broods currently were reported as aggressive, and the trend of loss appears to be upward. Major efforts by public and private agencies were continued during the year to salvage dead and dying trees.

PINE WEEVILS, *Hylobius*, *Pachylobius*, *Pissodes*, and *Cylindrocoptorus* spp. Several species of pine reproduction weevils were reported to be particularly destructive to pine seedlings and reproduction in many sections of the country. At times, a single weevil species was responsible for damage or tree killing; at others, two or more species were found in the infestation areas. *Hylobius* and *Pachylobius* spp. occurred in concentrated numbers in slash pine planting areas in parts of Florida, and the same insects were reported to be quite common in other states in the South and Southeast, where pine plantings were made in areas recently logged. *P. approximatus* Hopk. was reported to be increasing in numbers and causing considerable damage in various sections of Ohio and in adjacent states, where cutting in pine plantations has been heavy for Christmas trees. *H. radicis* Buch. was noticeably heavier in red and jack pine plantations in northwestern Wisconsin, in western Michigan, and at scattered locations in Minnesota. In all areas, this weevil was most severe in sandy soils. *Pissodes strobi* (Peck) also was noticeably heavier during 1958 in St. Lawrence County, New York, and in northwestern Wisconsin and Lower Michigan. In the Lake States, as much as 15-20 percent of the red pine and over 40 percent of the jack pine in plantations were found to be weeviled. In California, *Cylindrocoptorus eatoni* Buch. caused severe killing of sapling-sized ponderosa pines on a portion of the Stanislaus National Forest but the pest was not reported from other areas in the state where infestations have been severe in past years.

Control of pine reproduction weevils in the Southern and Southeastern States is being accomplished by delaying the planting of trees for about nine months after areas are logged. Dipping seedlings in insecticidal solutions is proving satisfactory for control. Aerial application of DDT used for control of *Cylindrocoptorus* in California, and lead arsenate and lindane were applied by ground methods for control of *P. strobi* in Pennsylvania, Michigan and New York.

SPRUCE BUDWORM, *Choristoneura fumiferana* (Clem.). The spruce budworm, a major pest of mixed conifer forests in all sections of the country, continued in epidemic status in susceptible host type in many areas from coast to coast. The most extensive infestations occurred in the northern Rocky Mountains, where nearly 6 million acres have been defoliated to some degree since the budworm epidemic developed there in the late 1940s. The rate of increase of new infestations in this region during the past two years has been less than heretofore, and extension of the older outbreaks in 1958 was not great. However, total area of active infestations in Montana and

north Idaho now occur on 3,521,700 gross acres. Control of these infestations was not attempted during 1958.

Budworm infestations in the Lake States also are extensive and defoliation during 1958 increased over prior years. Although some 1,300,000 acres of balsam fir forests in Michigan, Wisconsin and Minnesota are infested, defoliation in most areas was not severe. However, to avert tree mortality in severely defoliated areas, aerial spraying was undertaken and 12,000 acres were treated in northern Minnesota.

Increasing infestations over relatively large areas were reported from portions of southern Colorado and from northern New Mexico. In Colorado, defoliation was noted on more than 172,000 acres and in New Mexico on some 200,000 acres. In these two states, tree defoliation in some portions of the infested areas was severe, and fear is expressed that the host type will be threatened if the trend of populations continues to rise. There are no plans currently, however, for initiation of control.

In Maine, outbreak populations occurred on nearly 3 million acres but aerial spraying on 302,000 acres in that state reduced most infestations to endemic levels. However, subsequent to the aerial spraying program, an appreciable egg population was found along the western and southern edges of the sprayed area, and heavy infestations are reported for the first time in many years.

In eastern Oregon, budworm populations were particularly severe on a large acreage but aerial spraying on 818,000 acres reduced those infestations to the lowest levels since 1947. Although some 315,000 acres remain infested, the population trend is downward and need for additional controls is not anticipated in the near future.

Although spruce budworm infestations in California are restricted to the northeastern corner of the state, the severity of defoliation during the year increased and infestations spread southward.

BLACKHEADED BUDWORM, *Acleris variana* (Fern.). The blackheaded budworm is a periodic pest of western hemlock and Sitka spruce in coastal Alaska and in the hemlock alpine fir stands in the northern tier of Western States. After a lapse of two years, the insect was again found in the hemlock stands of southeast Alaska and, although light and moderate defoliation during the year was restricted to the vicinity of Ketchikan, increased budworm activity there and elsewhere in southeast Alaska is expected during 1959. The widespread infestations reported on the Kootenai National Forest in Idaho in 1957 subsided and now occur on only 1,500 acres in that area. The outbreak on some 253,000 acres in western Washington during 1957 also declined to 2,720 acres and complete collapse of this infestation is expected during the current year. A small subepidemic infestation on subalpine fir along the Tollgate-Troy ridge in eastern Oregon flared up during the summer months but was quelled by high larval parasitism during the autumn. In Idaho, an infestation on some 50,000 acres of alpine fir is restricted to high-altitude ridge tops. There was no need in any infestation area for direct control action.

JACK PINE BUDWORM, *Choristoneura pinus* Free. Populations of this major pest of jack pine in the Lake States were much reduced from levels occurring there during the past several years. However, an extensive area of host type on a portion of the Indian Sioux Roadless area in northern Minnesota was defoliated during 1958 and a moderate infestation occurred on the lower Peninsula of Michigan. It is of interest that extremely light populations were reported in northwestern Wisconsin, where epidemic infestations were present during 1956 and 1957. No direct action was needed in any area for control.

LARCH AND SPRUCE BUDWORMS, *Zeiraphera* spp. Two species of budmoths have been in epidemic status in portions of Oregon and Washington for the past several years. The larch budmoth, *Z. griseana* (Hbn.) in western larch stands on the Snoqualmie and Wenatchee National Forests in Washington increased during the year but populations attacking Douglas fir and white fir in both eastern and western Oregon continued light and caused no appreciable damage. *Z. ratzeburgiana* Sax., which has been in outbreak status in stands of Sitka spruce along the coastal areas of Oregon and Washington, declined to a few small spots and damage from the defoliation was slight.

DOUGLAS FIR TUSSOCK MOTH, *Hemerocampa pseudotsugata* McD. Five separate oubreaks of Douglas fir tussock moth were reported from New Mexico, Arizona and Idaho. One outbreak, first discovered on 125 acres on Pinal Mountain, Tonto National Forest, Arizona, in 1957, now occurs on 2,500 acres; another, first discovered in 1958 on Mt. Baker on the same national forest, is 3,000 acres in size. In New Mexico, some 300 air miles distant from the outbreaks in Arizona, the moth was found in outbreak status at two separate locations: one on the Lincoln National Forest in the southern part of the state, the other in the Sandia Mountains east of Albuquerque. Defoliation of white fir in the outbreak areas has been severe and tree mortality is expected in lieu of suppressive controls.

The 10,000-acre tussock moth outbreak reported from Owyhee County in southern Idaho was practically eliminated during the year by a virus disease affecting the larval population. This is the second time in ten years that outbreaks of tussock moth have been brought under control by a virus disease in this area. A closely related tussock moth, species unknown, was discovered in epidemic numbers on range plants in the foothills between Carson City and Reno, Nevada.

NEW MEXICO FIR LOOPER, *Galenara consimilis* Hein. An infestation of New Mexico fir looper, endemic in New Mexico since 1952, was discovered on some 1,500 acres in the Capitan Mountains during the late autumn months. The looper population currently is being held in check by a fungus disease and some 50 percent of the pupae collected from the soil in December were infected. The Douglas fir tussock moth also occurs in outbreak status in the looper infestation area, and combined feeding by both insects has been such that tree mortality is imminent on some 600 acres.

PINE BUTTERFLY, *Neophasia menapia* (Feld.). The pine butterfly, a periodic pest of ponderosa pine in the Western States, was found on some 50,000 acres on the Salmon National Forest in Idaho during the summer months. Damage to host trees was not great but egg deposition in the entire area is sufficient to cause concern that a new outbreak may be developing.

PINE NEEDLE MINERS, *Recurvaria* and *Argyresthia* spp. Damaging infestations of pine needle miners were reported at several locations during the year. The outbreak of *Recurvaria milleri* Busk., which has persisted for the past several years at Toulumne Meadows, Yosemite National Park, California, continued unabated in the lodgepole pine forests at that location and spread to additional areas as well. The pest was found at a new location on the Stanislaus National Forest and was reported as being abundant in that area, on a portion of the Inyo National Forest, and at Sequoia-Kings Canyon National Park. In addition, this species also occurred in outbreak numbers in a large section of a portion of the Sawtooth National Forest in Idaho, and on 1,500 acres in the Targhee National Forest in the same state. In these latter areas, defoliation has not resulted in tree killing. At Yosemite National Park, however, defoliation is now causing mortality of trees and, in lieu of suppressive controls, the entire stand of lodgepole pine currently affected is expected to be killed. Insecticidal formulations dispersed by aircraft and helicopter are being tested for control at Yosemite, with the intention of saving the lodgepole pine in the most heavily used recreational areas.

Another *Recurvaria* sp. which occurred in outbreak status in the Southwest during 1956 and 1957 disappeared during 1958. On the other hand, two new outbreaks of this unknown species occurred in Colorado: one was reported from the vicinity of Durango, and the other from an area southwest of Colorado Springs. Damage to trees in both areas, however, was not widespread.

During the early spring months, an outbreak of a needle miner of the genus *Argyresthia* caused extensive discoloration of foliage of ponderosa pine on the Warner District of the Freemont National Forest in southeastern Oregon, and there was fear that the attacked trees might be killed or so weakened as to be particularly susceptible to bark beetles. However, the mined needles dropped during the autumn months, leaving the trees in apparently healthy condition. Furthermore, at the time of pupation, the needle miner suffered considerable mortality from unknown causes and at present the infestation is not a threat to the pine stand in this area.

PANDORA MOTH, *Coloradia pandora* Blake. A light infestation of the pandora moth on ponderosa pine was reported from along the McKenzie Highway on the Deschutes National Forest in eastern Oregon. Feeding of the new brood occurred during September and October but the heavy feeding will take place in 1959 when the caterpillars mature. It is of interest that this new infestation is in the same general area where an outbreak of the same species appeared 25 years ago. The previous outbreak subsided naturally without causing appreciable damage to the resource attacked.

SPEAR-MARKED BLACK MOTH, *Eulype hastata* L. Stands of paper birch over relatively large areas in the vicinity of Fairbanks, Alaska, were severely defoliated by the spear-marked black moth during the summer months of 1957. This insect pest, undetermined at that time and not previously known to occur in Alaska, increased in numbers during the year and spread to a gross area of 5,829,000 acres. Heavy defoliation occurred on 333,000 acres but a sharp decline in the insect population, caused by a granulosis virus and insect parasitism, was noted in mid-season. The infestation is expected to decrease further in 1959. Direct control was not needed.

TENT CATERPILLARS, *Malacosoma* spp. Tent caterpillar infestations were reported from various sections of the country, and heavy populations in some areas caused severe defoliation of host trees. In the Western States, *M. fragilis* Stretch was particularly prevalent. Aspen stands in Colorado, for example, were completely defoliat-

ed on 130,000 acres and cumulative damage for as long as nine years is causing severe mortality of trees on 1,180 acres. Infestations were also abundant in Utah, Idaho, New Mexico, Montana and Arizona. One of the more serious of these infestations was on the Cache National Forest in Utah, where chokecherry and several brouse plants were completely stripped. The trend of infestations in Arizona and New Mexico was downward, and acreage of defoliation in those states was somewhat less than in previous years.

The forest tent caterpillar, *M. disstria* Hbn. was reported to be quite prevalent in many areas in Montana and North Idaho and, for the first time in four years, infestations appear to be increasing in those areas. The same species also increased in numbers in the Lake States and along the East Coast, and infestations were particularly severe in Pennsylvania, West Virginia, Wisconsin and Minnesota. In the latter state, defoliation of aspen occurred on 185,000 acres, and lesser amounts of feeding on an additional 625,000 acres.

The severity of tree defoliation in heavily used recreational areas in Colorado, Utah, New Mexico and Arizona prompted land-managing agencies to initiate suppressive controls. Although most areas needing control action were of small size, a total of 6,100 acres were treated during the year.

PINE SAWFLIES, *Diprion* and *Neodiprion* spp. Several species of pine sawflies were reported in outbreak status from many sections of the country. In some places, defoliation was severe over large areas; in others, trees on smaller areas were defoliated to a lighter degree. *N. pratti pratti* (Dyar) occurred sporadically on Virginia pine in a broad zone from northern Virginia south to North Carolina, a gross area of approximately 2,750,000 acres. In Florida, some 300,000 acres of loblolly pine in five counties were partially defoliated by species identified as *N. excitans* Roh., *N. lecontei* (Fitch), *N. abbottii* (Leach), and *N. compar* (Leach). *N. excitans* also was identified as the species causing defoliation of scattered areas of loblolly pine in southeast Texas, and *N. lecontei* defoliated young plantations of all southern pine species at various places in the Southern States. *N. taedae linearis* Ross was reported from southern Arkansas and northern Louisiana but defoliation was usually light. In Missouri, the widespread infestation of the latter species in 1957 failed completely to reappear.

Several other sawflies caused noticeable damage to natural and planted pines in the Northeastern States. A species attacking pitch and short leaf pine, believed to be *N. pratti paradoxicus* Ross, occurred on over 1,630 square miles in south-central New Jersey; *N. sertifer* (Geoff.) was abundant locally in portions of New York, Connecticut, New Jersey and Pennsylvania, and *N. lecontei* increased in such numbers in New York that applied control may be needed to prevent tree killing on large acreages in 1959. In the Lake States, infestations of *N. lecontei* were reported as severe in portions of Michigan and Wisconsin and control is forecast for 1959. Other species, such as *N. sertifer*, *N. pratti banksianea* Roh and *D. similis* (Htg.), all occurred in portions of Minnesota, Wisconsin and Michigan. *N. pinetum* (Nort.) was reported to have caused complete defoliation of white pine in some places in Ohio but heavy infestations did not cover large acreages. *N. fulviceps* complex was noted defoliating ponderosa pine in the vicinity of Grants, New Mexico, but no tree mortality occurred in the affected area. An unidentified *Neodiprion* species defoliated lodgepole pine on two islands in Granby Reservoir, Colorado, and a small spot infestation on the same tree species was reported on the Willamette National Forest in central Oregon. This latter species has occurred over extensive areas in Oregon in previous years, last reported on some 70,000 acres in 1953.

BALSAM WOOLLY APHID, *Chermes piceae* (Ratz). The balsam woolly aphid was first discovered in the Pacific Northwest in 1954. Since then, the extent and severity of infestations increased rapidly in each succeeding year. In 1958, however, intensity of damage in both Oregon and in Washington decreased. Nevertheless, very aggressive bole infestations were prevalent in the subalpine fir stands in the Cascade Range late in the season, indicating that the outbreak may increase in severity in these stands during 1959. In Pacific silver fir, the heaviest centers of damage are in the Green, Toutle, and Kalama River drainages on the Gifford Pinchot National Forest in Washington. However, considerable improvement of damaged trees was noted in the Lewis River drainage. The insect was discovered in Mt. Ranier National Park for the first time, and this marks the northernmost point the insect has been found in Washington.

Damage by the aphid in the Northeastern States is also assuming serious proportions, and tree mortality is occurring throughout most of Vermont and in the White Mountain National Forest in New Hamsphire. In Maine, an apparent increase in populations resulted in more gout injury to trees along the coast and on the Penobscot Experimental Forest near Bangor. In the latter area, stem attacks are more severe and tree mortality appears imminent.

In the Southeast, this aphid, previously thought to be *Chermes nusslini* Bor., was responsible for the killing of thousands of Fraser firs

on Mt. Mitchell, North Carolina, and infestations now are known in Virginia as well. Estimates from surveys indicate that some 25 percent of the fir resources on Mt. Mitchell are now dead and that 90 percent of the remaining trees are threatened.

In lieu of suitable measures to combat aphid infestations by direct means, major efforts were made during the year to introduce predators from Europe and Japan for biological control. The severity of tree killing by the aphid in all areas of infestation has prompted an accelerated program by landowners and land managers to salvage dead and dying trees.

EUROPEAN PINE SHOOT MOTH, *Rhyacionia buoliana* (Shiff.). The severity and extent of European pine shoot moth infestations during 1958 continued at about the same levels and in the same parts of the country as in the past several years. The moth was present throughout Ohio wherever red pines occurred in plantations, and infestations ranging from light to heavy were reported from many parts of Indiana as well. Populations were particularly high in Carbon County, Pennsylvania, and in portions of West Virginia, New York, Southern Connecticut, Lower Michigan, parts of Wisconsin, and in Minnesota.

Other *Rhyacionia* moths also occurred at about the same level of intensity and in the same parts of the country, as reported in previous years. *R. frustrana* (Comst.) and *R. rigidana* (Fern.) caused severe damage to shortleaf pine plantations at several locations on the Brownstown Ranger District, Hoosier National Forest, Indiana, in " The Pounds " area on the Shawnee National Forest in the same state, and in eastern Maryland. Moderate to severe infestations were reported throughout Ohio, in Delaware, in most of the Southern States, and in all of the Southeastern States. An undetermined species was reported as causing considerable damage to ponderosa pine reproduction on the Custer National Forest in Montana.

An expanded program of research on biology, ecology and control of shoot moths led to the development of more suitable methods to suppress infestations in plantations, and pilot control tests on some 500 acres of red pine plantations were conducted in southern Michigan and in Pennsylvania. Preliminary results of these tests indicate satisfactory control.

GYPSY MOTH, *Porthetria dispar* (L). The gypsy moth was generally at a lower level in the Northeastern States during the year and in the newer infestation area in Michigan. Aerial spraying programs by the states and the federal government were needed, however, to suppress populations in Pennsylvania, New York, Connecticut, Massachusetts and Maine. No spraying was undertaken in Michigan. The total area sprayed in all states amounted to 510,000 acres.

ELM SPANWORM, *Ennomos subsignarius* (Hbn.). Defoliation of hardwoods by the elm spanworm in the mountains of Georgia, Tennessee and North Carolina occurred on a much larger acreage in 1958 than was reported in 1957. Currently, infestations are known to occur on more than a million acres, a half million of which were severely defoliated. A pilot test was undertaken during the year to determine timing and dosages of DDT sprays needed for control of this pest species. If natural factors fail to bring this infestation under control, aerial application of DDT sprays may be needed to protect the resource affected.

SPITTLEBUGS, *Aphrophora* spp. Red pine plantations in portions of Michigan, Wisconsin and Minnesota are often seriously damaged by Saratoga spittlebug, *A. saratogensis* (Fitch), when this insect pest is abundant, and suppressive measures for control are usually required to protect planted trees until they grow beyond susceptible size. Although populations of the spittlebug were quite heavy in Wisconsin and Minnesota early in the year, late spring frosts materially reduced nymphal populations and control was found to be unnecessary in many areas. In Michigan, damage within infested stands was spotty but most conspicuous in the northern Lower Peninsula. Suppressive controls were undertaken on some 4,500 acres of public and private plantations in the three states.

The pine spittlebug, *A. parallela* (Say), was reported to have occurred in moderate numbers in stands of white pine on the Mohican State Forest in Trumbull County, Ohio, but damage to host trees was not severe and control was not necessary. The latter species, or a closely related one, was also reported more common in 1958 than usual on pitch and shortleaf pines in southern New Jersey, on loblolly pine on the upper Eastern Shore of Maryland, and in Delaware.

LARCH SAWFLY, *Pristiphora erichsonii* (Htg.). The larch sawfly continues as a major pest of stands of tamarack in the Lake States, and the extent of infestations in 1958 was greater than in other years. The intensity of infestations increased in portions of Wisconsin and Minnesota, where reports of tree killing were received from many areas. In Michigan, all of the larch stands in the Upper Peninsula suffered at least 20 percent defoliation and some stands were more than 60 percent defoliated. It is noteworthy that an infestation affecting western larch, dis-

covered in Missoula County, Montana, was the first record of the insect in the northern Rocky Mountains since 1944.

SPRUCE MITE, *Oligonychus ununguis* (Jac.). Infestations of the spruce spider mite, which erupted to epidemic proportions in stands of Douglas fir in Idaho and Montana during 1957, were reported to be persisting on several of the national forests east of the Continental Divide in Montana. The mite populations, found to be heaviest in areas sprayed with DDT for control of spruce budworm in earlier years, were reported as decreasing, however, and tree killing as a result of infestations did not occur.

SPRUCE MEALYBUG, *Puto* sp. The infestation of spruce mealybug in stands of Engelmann spruce in southern Utah was reported as very active in 1958. Although the area of infestation has not increased beyond the 60,000 acres infested previously, continued heavy feeding is rapidly reducing the vigor of mature trees and is causing some deformity in the younger ones. Another mealybug, unidentified as to genus, was reported from southern Utah. This species, attacking true firs, white bark pine, spruce and lodgepole pine, occurs on an area of some 6,000 acres. There was little or no damage to affected trees. No control was attempted in either infested area.

PINE NEEDLE SCALE, *Phenacaspis pinifoliae* Fitch. Infestations of pine needle scale are often reported from place to place in the pine stands of the Western States. During 1958, one outbreak on ponderosa pine was stated to have spread and became more conspicuous around orchards in the vicinity of Wenatchee, Washington. These infestations have been observed for the past several years and are attributed to the effects of spray drift from the orchards. Another outbreak center on 10,400 acres was recorded on the Colville Indian Reservation in Washington. The cause of this latter outbreak was not reported.

LARCH CASEBEARER, *Coleophora laricella* (Hbn.). An outbreak of the larch casebearer, first discovered in 1957 on some 15,000 acres in the vicinity of St. Maries, Idaho, was a new locality record for this forest pest. Surveys during 1958 revealed that the insect is present on some 110 square miles in northern Idaho and northeastern Washington. Although no visible defoliation was observed outside the 15,000-acre area reported in 1957, the insect was found in small numbers north of Sandpoint, Idaho, and Chewelah, Washington. The southern edge of the infestation is believed to be in the vicinity of Clarkia, Idaho.

PINE LEAF APHID, *Pineus pinifoliae* Ficht. The pine leaf aphid, which was particularly abundant in the Northeastern States during 1957, was much reduced in 1958. However, on the areas where infestations have persisted for as long as five years, affected trees are being killed. Lower levels of infestation were also reported from the Lake States, where the insect was quite prevalent in past years. Another aphid, tentatively identified as *P. coloradensis* Gill, was reported from extensive areas in Montana and North Idaho, and although affected trees were not killed, there was a serious loss of two- and three-year-old needles, which caused deterioration of crowns of attacked trees. The pine bark aphid, *P. strobi* (Htg.), was recorded as abundant on white pine in nearly all of the Northeastern States, and particularly in the vicinity of Parsons, West Virginia, in portions of Maine, and in New York.

FALL WEBWORM, *Hyphantria cunea* Drury. The fall webworm was reported from many areas throughout the country but infestations in most places were not viewed with particular alarm. Trees and shrubs in a rather large area west of Ft. Collins, Colorado, and south of Colorado Springs, were severely defoliated during the year, and the cumulative effect of defoliation is depleting shade trees in those areas, and is otherwise detrimental aesthetically. The webworm was also common in the southern part of the Lower Peninsula of Michigan, where it caused complete defoliation of ash in affected areas. Wherever infestations occurred in areas frequented for recreation purposes, populations were suppressed by direct means.

LARGE ASPEN TORTRIX, *Archips conflictana* Wlkr. The large aspen tortrix was reported to have caused light to moderate defoliation on 220,450 acres of aspen on the Grand Mesa, Uncompahgre, Gunnison, and the San Juan National Forests in Colorado, and throughout most of the Upper Peninsula of Michigan. Tree killing was not reported in any area where defoliation was extremely heavy and no measures were undertaken for control. An unidentified leaf roller, also on aspen, was reported on 1,300 acres in northern New Mexico.

The fruit tree leaf roller, *A. argyrospilla* (Wlkr.) which occurred in epidemic numbers in the Lower Peninsula of Michigan in 1957, was drastically reduced by parasites and late spring frosts.

ORANGE-STRIPED OAK WORM, *Anisota senatoria* A. & S. Reports were received that severe defoliation in a wide area in the Connecticut River Valley and in Rhode Island was caused by the orange-striped oak worm, and that the pest was unusually abundant in southern New Jersey,

Maryland and in Pennsylvania. In the vicinity of Tamworth, New Hampshire, *A. rubicunda* (F.) was recorded to have caused heavy defoliation of sugar and red maple. In Lower Michigan, the red-humped oak worm, *Symmerista albicosta* (Hbn.), defoliated some 21,000 acres of oak woodland. No control was needed in any area.

ASPEN LEAF MINER, *Phyllocnistis populiella* Chamb. The aspen leaf miner has been in epidemic status for some ten years on four national forests in western Wyoming and southwestern Idaho. The infestations were reported active again in 1958 and nearly all of the aspen foliage in affected areas has been heavily mined. At the Teton National Forest, much of the foliage on affected trees has been stunted, and some patches of aspen up to 10 acres in size have been killed. Thus far, there has been no effort made to suppress populations by direct means.

INSECT PESTS OF SEEDS AND CONES OF CONIFERS. The status of insects affecting the seeds and cones of coniferous trees is not known in detail, except where special surveys are undertaken to determine their abundance and destructiveness. In California, such surveys were made, and cone moths, seed chalcids and midges were reported as causing serious damage to the 1958 seed crop from Jeffrey, ponderosa and sugar pine, and Douglas fir. Cone moths were identified as belonging to the genera *Barbara*, *Dioryctria*, *Laspeyresia*, and *Hedula*; the seed chalcid as *Megastigmus spermotrophus* Wachtl.; the midges as *Contarinia* sp., and the cone beetles as *Conophthorus* spp. Seeds and cones in some areas examined were less seriously affected than others but generally, damage was so great that seeds could be collected profitably only in a few areas. Public and private agencies are exploring suitable methods for control of cone and seed insects, particularly in areas set aside as seed orchards.

Conophthorus resinosae Hopk. was reported to be abundant in portions of Michigan, where new growth on red pine poles and larger trees was damaged. In this area, the cone beetle attacked new shoots of trees only because the 1958 cone crop was scarce.

TULIPTREE SCALE, *Toumeyella liriodendri* (Gmel.). Heavy infestations of tuliptree scale were reported in localized areas in southern Kentucky, throughout Ohio, and in southern Illinois. In these latter areas, young reproduction as well as merchantable-sized trees were severely damaged.

WALNUT CATERPILLAR, *Datana integerrima* G. & R. The walnut caterpillars caused moderate to complete defoliation of black walnut in southern Ohio, northern Kentucky, and at a few places in other of the Central States. The insect also occurred in outbreak numbers at Carlsbad Caverns National Park in southeastern New Mexico but excessive damage to affected trees was averted by mist-blower application of DDT sprays. *D. ministra* (Drury) caused noticeable damage in New Castle County, Delaware, and the insect appears to be generally present in the complex of hardwood defoliators from Massachusetts southward to Maryland.

MIMOSA WEBWORM, *Homadaula albizziae* Clarke. Heavy infestations of mimosa webworm were reported from the vicinity of Indianapolis and Dayton, Ohio, and lighter infestations occurred generally over the western portion of Ohio, in central Indiana, and in western Kentucky. Although the insect occurs in other states in the eastern half of the country, no reports were received of outbreak infestations in any of these areas.

BAGWORM, *Thyridopteryx ephemeraeformis* (Haw.). Bagworms defoliating and killing white pines were reported from Delaware County, Ohio, where trees were infested with 200 to 300 bagworms per foot of tree height. In Delaware, Maryland and New York, populations also were abundant and injurious to red cedar and arborvitae.

SADDLED PROMINENT, *Heterocampa guttivitta* (Wlkr.). At periodic intervals the saddled prominent is a serious pest of birch in the Eastern States. In 1956 a large-scale outbreak was reported in portions of several of the Northeastern States but by 1957 all infestations had collapsed from natural causes. In 1958, a new infestation was reported on the southwestern slopes of Bald Mountain in New Hampshire. The extent of this infestation is not known.

MAPLE LEAF CUTTER, *Paraclemensia acerifoliella* (Fitch). The maple leaf cutter defoliated several thousand acres of maple in Lewis County, New York, and infestations in local areas were reported from most of Vermont. Generally speaking, infestations of this insect seldom require suppressive measures for control and none were undertaken in 1958.

VARIABLE OAK LEAF CATERPILLAR, *Heterocampa manteo* (Dbldy.). The variable oak leaf caterpillar was very abundant in several sections of Delaware and Maryland. In the latter state infestations were reported to be concentrated in Cecil County, with most severe defoliation in the vicinity of Port Deposit and Principio Furnace.

RED PINE SCALE, *Matsucoccus resinosae* B. & G. No change was reported in the status of

red pine scale infestations in the generally infested area in the vicinity of Bridgeport, Connecticut. Low winter temperatures may have killed portions of the brood of this pest, thus resulting in a lessening of tree killing from the level sustained in past years.

TEXAS LEAF-CUTTING ANT, *Atta texana* Buckley. Damage to planted seedlings by the Texas leaf-cutting ant was reported from several areas in east Texas and in Louisiana. Although the ants are not usually destructive to forest trees, they often become pests of pine seedlings and reproduction during the winter months when other green plants are unavailable. The ants appear to have become more abundant in recent years, presumably because of drier soil in drought areas.

Observations on Potato Diseases in Peru

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Spread of two potato diseases to coastal plain

Among diseases affecting potatoes in Peru, powdery scab (*Spongospora subterranea*) and Andean disease (*Thecaphora solani*), together with rust (*Puccinia pittieriana*), Peruvian rust (*Aecidium cantensis*) and wart disease (*Synchytrium endobioticum*), were recognized as diseases characteristic of mountain areas and had not been known to occur on coastal plains. In 1958, the known ranges of distribution of these two diseases, however, were extended.

In 1952, it was established experimentally at the Agricultural Experiment Station, La Molina, that powdery scab could be reproduced by artificial infection under conditions prevailing on the coast. When diseased potato tubers were grown in pots containing naturally infested soil from the mountains, the new tubers produced were infected to the extent of 6.4 percent. On the other hand, when infected tubers were planted in soil from the plain, even if the soil was artificially infested with the pathogene, the disease could not be reproduced. In 1958, natural infection of this disease occurred in the coastal area. Up to 5 percent of tubers of the Huasahuasi variety, grown in a farm at the Chillón Valley, were found to be infected.

In 1954, A. Quevedo first observed Andean disease on wild *Solanum stoloniferum* grown in the experimental plot at La Molina. In 1958, this disease was found in large potato fields of the Bocanegra farm at the Central Valley of of the coastal area, infecting the variety Peruanita and causing losses up to 50 percent of yield.

Discovery of Verticillium wilt

The latest potato disease discovered in Peru is caused by *Verticillium albo-atrum*, which had previously been mistaken for *Fusarium oxysporum*. This disease has become a limiting factor for potato growing in the Central Valley, because it reduces considerably the vegetative period of the Huasahuasi variety, which is well adapted to local conditions. When this variety was introduced into the coastal area it had a vegetative growing period of four to five and a half months. In recent years, however, the plants usually died after three and a half months or less, and it has been established that this is due to the premature death caused by Verticillium wilt. Recent surveys show that Verticillium wilt is now the main disease of potato in the coastal area, and there is no means of control, except the development of resistant varieties.

Late blight

Since 1946, late blight (*Phytophthora infestans*) has occurred, with varying intensity, on the coastal plain as well as in the mountains, but during the last two years it has appeared only sporadically.

In the coastal area, the disease attacks only aerial parts of potato plants but not tubers. Winter drizzle is insufficient to carry zoospores through the soil to infect tubers, when potatoes are cultivated in hilled rows. But in Cañete, where potatoes are not hilled, tubers near the surface may be infected. In the mountains, both aerial and underground parts of the plant are attacked.

Late blight on the plain can be controlled readily by the application of fungicides, as the weather is rather dry during the growing season. Best results have been obtained with fungicides containing maneb (Manzate and Dithane M-22) or zineb (Dithane Z-78 and Parzate). In the mountains, late blight is more difficult to control because of frequent rains during the growing season. In order to escape from attacks of late blight, potatoes must be planted very early in

the irrigated areas, i.e., July-August; otherwise, repeated and timely applications of fungicides would be necessary. In the few trials carried out in this area, copper fungicides (Perenox, Copper-A-Compound, etc.) gave most satisfactory results.

Determination of races of *Phytophthora infestans* in Peru was first made by the writer [1] and by W. Black [2] and later by A. Quevedo. [3] The races identified so far, following the international nomenclature proposed by Black [4] are:

Race 0	Race 2, 4
2	3, 4
3	1, 2, 3
4	1, 2, 4
1, 2	1, 3, 4
1, 3	1, 2, 3, 4
2, 3	

Virus diseases

Virus diseases of potatoes are widespread throughout the country. Most identifications, however, were based only on symptoms observed in the field, and several diseases, such as the one referred to as " calico," may not be due to viruses but are hereditary in nature. The only potato virus disease identified in Peru by host inoculation is latent mosaic caused by potato virus X. Two strains of this virus, known as potato mottle virus and potato ring spot virus, were determined in 1945 and 1946.

Observations of symptoms indicate that the following virus diseases of potato also exist in Peru: purple top, calico, crinkle, leaf roll and spindle tuber.

In 1952, characteristic and conspicuous symptoms of virus Y, i.e., veinal necrosis and leaf-drop streak, were observed for the first time on isolated plants collected from fields at Tarma and the Agricultural Experiment Stations at La Molina and Carabayllo. Later, the same symptoms were observed in other valleys. In this connection, it is of interest to note that in 1937 British scientists were unable to prove the presence of virus Y in 59 potato varieties introduced from Peru, but in 48 varieties the following viruses were found: potato virus X and potato virus B (a strain of virus X), potato aucuba mosaic virus and potato virus F (a strain of aucuba mosaic virus), and virus C, which is now considered a strain of potato virus Y. In 1941, Brazilian investigators found virus X and another virus similar to Virus Y on some varieties from central and northern Peru.

Other potato diseases

In addition to the diseases mentioned above, the following potato diseases have been identified since 1928 in Peru:

Early blight (*Alternaria solani*)
Fusarium wilt (*Fusarium oxysporum*)
Powdery mildew (*Oidium* sp.)
Rhizoctonia disease (*Rhizoctonia solani*)
Black dot (*Colletotrichum atramentarium*)
Sclerotinia wilt (*Sclerotinia sclerotiorum*)
Botrytis cinerea
Sclerotium wilt (*Sclerotium rolfsii*)
Silver scurf (*Spondylocladium atrovirens*)
Charcoal rot (*Macrophomina phaseoli*)

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[1] Bazán de Segura, C., 1952. Razas fisiológicas de *Phytophthora infestans* en el Perú. Investigaciones sobre resistencia de especies, variedades e híbridos de papa al *P. infestans*. In C.N.I.E.A. "La Molina" 1951. *Bol. Cent. Invest. Agric.*, Lima. No. 46: 3–14. (Mimeographed).

[2] Black, W. 1957. Incidence of physiological races of *Phytophthora infestans* in various countries. *Annual Report Scottish Society for Research in Plant Breeding 1957*. pp. 43–49.

[3] Quevedo, D. A., 1958. Resistencia a nuevas razas de *Phytophthora infestans* en el Perú. Est. Agric. "La Molina". *Bol. Tec.* 70.

[4] Black W. *et al.* 1953. A proposal for an international nomenclature of races of *Phytophthora infestans* and of genes controlling immunity of *Solanum demissum* derivates. *Euphytica* 2: 173-179.

Outbreaks and New Records

NICARAGUA

George H. Berg, Expanded Technical Assistance Program, FAO, Managua

Discovery of Mediterranean fruit fly

During January 1959, the Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA) initiated a new program designed to prevent the spread of the Mediterranean fruit fly (*Ceratitis capitata* Wied.) from Costa Rica into other OIRSA member countries (Mexico, Guatemala, El Salvador, Honduras, Nicaragua and Panama). Briefly, this program consists of having squads of men carry out a detailed trapping scheme for the purpose of determining the presence or absence of the fly along the Nicaraguan-Costa Rican and the Panamanian-Costa Rican frontiers, as well as to survey the existing host plants, both cultivated and wild. The territory under surveillance consists of a "security" or "buffer zone" 30 kilometers wide in Nicaragua and a "presecurity" or "prebuffer zone" 30 kilometers wide in Costa Rica, that stretches along their entire mutual frontier. At the Panamanian-Costa Rican frontier, a "buffer zone" and a "prebuffer zone" of equal width were delimitated in Panama and Costa Rica respectively. At the same time, the OIRSA Mediterranean Fruit Fly Department was prepared to initiate eradication measures immediately upon detecting any outbreak area within either of the zones at these frontiers.

During the course of initiating the trapping program in the Nicaraguan sector, McPhail liquid-lure traps containing protein hydrolysate and ammonium chloride mixed with water, were placed at El Castillo, Nicaragua, on 9 February 1959 and at Isla Grande on 10 February 1959. These two localities are situated along the San Juan River between Lake Nicaragua and the Caribbean Sea. In El Castillo, the traps were placed on the following trees: sour orange (*Citrus aurantium*), sweet orange (*Citrus sinensis*), tropical almond (*Terminalia catappa*) and soursop (*Annona muricata*). At Isla Grande, the traps were hung on trees of guava (*Psidium guajava*), sweet orange (*Citrus sinensis*) and star apple *Chrysophyllum cainito*). In both of these localities, in addition to the trees already named, there were also rose apple (*Eugenia jambos*), bread fruit (*Artocarpus altilis*), guava (*Psidium guajava*) and mombins (*Spondias* spp.). These host plants, as a group, occurred only in the immediate vicinity of the aforementioned localities and among them were certain hosts that must be considered as the preferred hosts of the Mediterranean fruit fly.

On 6 April 1959, inspection of a trap on a star apple tree at Isla Grande, Nicaragua, revealed the presence of one adult female of Mediterranean fruit fly. On the following day, inspection of a trap on a sour orange tree at El Castillo, Nicaragua, revealed one male specimen of the fly. Inspection of traps between these two localities, which are separated by a distance of approximately 30 kilometers, failed however to reveal additional specimens. The discovery of these two specimens of the fly represents the first record of this species within Nicaragua.

Subsequent checks of the traps placed along the San Juan River in Nicaragua, including those located at Isla Grande and El Castillo, failed to reveal additional specimens of the Mediterranean fruit fly. In the meantime, eradication measures were put into effect as quickly as possible at the two sites where the pest was encountered, using a spray containing protein hydrolysate and malathion mixed with water, as well as treating the ground under all host plants with heptachlor. It is intended that dieldrin will be used in the future to ensure longer residual effect.

In order to ascertain the effectiveness of the eradication measures and the efficiency of quarantine services in operation, and to determine host distribution in this general area, the writer visited the entire area lying between San Carlos

and El Castillo, Nicaragua, along the San Juan River, during the period 20-23 April 1959. Examination of all traps located in El Castillo and Isla Grande failed to reveal additional specimens of the Mediterranean fruit fly. In addition, many ripe fruits of sour orange, guanábana or soursop, star apple and guava were cut and inspected without revealing a single larva of the fly. The only fruit fly larvae collected were those of *Anastrepha striata* Schiner, which were found in ripe guava. At the time when the writer was in this area, the control squads were spraying all host plants in the two infested localities, as well as at points of potential danger between San Carlos and El Castillo.

If additional checks in the future consistently fail to reveal the presence of the Mediterranean fruit fly at the two localities under discussion, or in any other localities along the San Juan River, then it could be considered that the fly was unable to establish itself after invasion, due to the small number of specimens present; or it might be that the prompt eradication measures had eliminated the very small population in existence. Quarantine and customs officials stationed at inspection points along the San Juan River disclosed that up to the time a plant quarantine inspector was placed at El Castillo, fruit had been passing from Costa Rica into this sector of Nicaragua by an all-water route. Under these conditions it is not surprising that two relatively widely isolated areas could be almost simultaneously infested.

Unless infested host material is carried by man along the various waterways that extend from Costa Rica into Nicaragua, the Mediterranean fruit fly under natural conditions would spread very slowly through this area. This is due to the fact that the vast majority of the hosts of the Mediterranean fruit fly, and especially those hosts that are preferred by the fly in Costa Rica, only occur in widely scattered and isolated localities in small towns and private properties. Between the towns and the private properties are jungles, marshes and some pasture land. In such areas, the two predominant hosts seem to be guava and a sapotaceous fruit with a very thick, hard rind, locally known as " popojote. " Since both hosts have well-defined periods of maturity, there is no succession of host plants on which the fly may subsist. In addition, there are strong, prevailing east and west winds and heavy rainfall during the greater part of the year. These factors, combined with a program such as OIRSA now has under way, could prove most effective in stopping the spread of this pest. The effectiveness of the OIRSA Mediterranean fruit fly program was indicated by the prompt discovery of the fly at the frontier and the efficient eradication measures immediately undertaken. Whether it will be able to continue to keep the Mediterranean fruit fly from spreading to other countries from Costa Rica is, however, a question which involves a number of factors and is difficult to answer at present.

Plant Quarantine Announcements

UNITED STATES

A Foreign Quarantine Notice of 16 December 1958, published in the *Federal Register*, Vol. 23, No. 248, on 20 December 1958, amends Quarantine No. 29, under which provision the importation of sweet potatoes and yams (*Dioscorea* spp.) from all foreign countries was prohibited. The new amendment removes yams from the prohibitory status under Quarantine No. 29, and automatically places their importation for consumption under the provisions of Fruit and Vegetable Quarantine No. 56, and their importation as propagating material under the requirements of Nursery Stock, Plant and Seed Quarantine No. 37.

A further foreign quarantine notice of same date, published in the same issue of the *Federal Register*, contains administrative instructions prescribing the method of treatment of yams from West Indies, in connection with Quarantine No. 56.

Yams may be imported from West Indies exclusively under permit, and only if they are fumigated upon arrival at the port of entry with methyl bromide at normal atmospheric pressure in an approved fumigation chamber at the following rates:

Temperature °F.	*Dosage in pounds of methyl bromide per 1,000 cubic feet*	*Exposure period, in hours*
90-96	2.5	4
80-89	3.0	4
70-79	3.5	4

Yams produced in Cuba may be eligible for entry under permit if fumigated in Cuba in an approved fumigation plant in the prescribed manner with methyl bromide, under supervision of a representative of the Plant Quarantine Division, United States Department of Agriculture.

REPUBLIC OF THE PHILIPPINES

1. Administrative Order No. 2 of 23 December 1958, published in the *Official Gazette*, Vol. 55, No. 5, of 2 February 1959, revises Administrative Order No. 2 of 17 September 1954 (see *FAO Plant Prot. Bull.* 3 : 47 . 1954 .), containing regulations governing the importation and exportation of plant materials. The new Order differs from the 1954 Order in the following aspects:

   (*a*) Seeds of vegetables and flowering plants for planting not exceeding half a pound either imported personally or sent as gifts from abroad, and bouquets, when not governed by special quarantine orders, are included as plant materials which may be imported without permit. In addition, as was also provided in the 1954 Order, fruits, vegetables, cereals and other plant products for food purposes, or properly dried, sterilized or poisoned botanical specimens when free from sand, soil or earth, may be imported without permit.

   (*b*) The following additional places are included in the list of ports of entry: Sual, Pangasinan, Hondagua, Dumaguete, Hinigaran, Pulupandan and Batangas.

2. Plant Industry Administrative Order No. 12, published in the *Official Gazette*, Vol. 55, No. 8, of 23 February 1959, revises the Order of 18 August 1949, regulating the importation of cacao plants and parts thereof, in order to prevent the introduction of swollen shoot virus, witches broom (*Marasmius perniciosus*), virus diseases, etc.

The importation of *Forastero* or *Trinitario* types of cacao, including their hybrids, for planting or propagation from any foreign country is prohibited except those covered by a permit previously issued by the Director of Plant Industry.

The importation of cacao plants and parts thereof of the *Criollo* type, such as fresh cacao beans, pods, seedlings, budsticks and other parts capable of propagating and carrying the diseases mentioned above from West Africa, Ceylon, Colombia, etc., is prohibited. However, small quantities of such materials may be imported through the port of Manila for scientific purposes. Such importations must be made through the Director of Plant Industry, subject to the provisions of Administrative Order No. 2 and to the conditions that the imported stock must be held under quarantine.

Importation of dried cacao beans not capable of propagation for private or commercial purposes from West Africa, Ceylon, Colombia, and any other foreign country, will be permitted if the shipment is covered by a permit issued by the Director of Plant Industry and accompanied by a certificate issued by the competent authorities of the country of origin, stating that the shipment is free from injurious insects and diseases.

ROMA, 1959 — Tipografia del Senato del Dott. G. Bardi.

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